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CHAPTER 15

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

SECTION BC 1501 GENERAL

1501.1 Scope. The provisions of this chapter shall govern the design, materials, construction and quality of roof assemblies, and rooftop structures.

SECTION BC 1502 DEFINITIONS

1502.1 Definitions. The following terms are defined in Chapter 2:

AGGREGATE.

BALLAST.

BUILDING-INTEGRATED PHOTOVOLTAIC (BIPV) PRODUCT.

BUILT-UP ROOF COVERING.

BULKHEAD.

CONTAINER GARDEN.

Chapter 27 of the Rules of the City of New York defines the term **GREEN ROOF SYSTEM**.

INTERLAYMENT.

MECHANICAL EQUIPMENT SCREEN.

METAL ROOF PANEL.

METAL ROOF SHINGLE.

MODIFIED BITUMEN ROOF COVERING.

PENTHOUSE.

PHOTOVOLTAIC MODULE.

PHOTOVOLTAIC PANEL.

PHOTOVOLTAIC PANEL SYSTEM.

PHOTOVOLTAIC SHINGLES.

POSITIVE ROOF DRAINAGE.

RADIANT BARRIER.

REROOFING.

ROOF ASSEMBLY.

ROOF COVERING.

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ROOF COVERING SYSTEM.

ROOF DECK.

ROOF RECOVER.

ROOF REPAIR.

ROOF REPLACEMENT.

ROOF VENTILATION.

ROOFTOP STRUCTURE.

SCUPPER.

SINGLE-PLY MEMBRANE.

SUSTAINABLE ROOFING ZONE.

UNDERLAYMENT.

VEGETATIVE ROOF.

SECTION BC 1503 WEATHER PROTECTION

1503.1 General. Roof decks shall be covered with approved roof coverings secured to the building or structure in accordance with the provisions of this chapter. Roof coverings shall be designed and installed in accordance with this code and the manufacturer's instructions such that the roof covering shall serve to protect the building or structure.

1503.2 Flashing. Flashing shall be installed in such a manner so as to prevent moisture entering the wall and roof through joints in copings, through moisture-permeable materials and at intersections with parapet walls and other penetrations through the roof plane.

1503.2.1 Locations. Flashing shall be installed at wall and roof intersections, at gutters, wherever there is a change in roof slope or direction and around roof openings. Where flashing is of metal, the metal shall be corrosion resistant with a thickness of not less than 0.019 inch (0.483 mm) (No. 26 galvanized sheet).

1503.3 Coping. Parapet walls shall be properly coped with noncombustible, weatherproof materials of a width no less than the thickness of the parapet wall.

1503.4 Roof drainage. Design and installation of roof drainage systems shall comply with Chapter 11 of the *New York City Plumbing Code* and this section.

1503.4.1 Secondary (emergency overflow) drains or scuppers. Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary (emergency overflow) drains, leaders and conductors shall comply with Chapter 11 of the *New York City Plumbing Code*, as applicable.

1503.4.2 Scuppers. When scuppers are used for secondary (emergency overflow) roof drainage, the quantity, size, location and inlet elevation of the scuppers shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1611.1. Scuppers shall not have an opening dimension of less than 4 inches (101.6 mm). The flow through the primary system shall not be considered when locating and sizing scuppers.

†††**1503.4.3 Gutters.** Gutters placed on the outside of buildings shall be of noncombustible, corrosion-resistant materials. Leaders placed on the outside of building shall be of noncombustible, corrosion-resistant materials in accordance with Chapter 11 of the *New York City Plumbing Code*. Gutters and vertical sections of exterior leaders shall be adequately anchored. Gutters and leaders installed more than 15 feet (4572 mm) above grade shall be designed to resist loads in accordance with Chapter 16 of this code.

1503.5 Attic and rafter ventilation. Intake and exhaust vents shall be provided in accordance with Section 1203.2 and the vent product's manufacturer's instructions.

1503.6 Crickets and saddles. A cricket or saddle shall be installed on the ridge side of any chimney or penetration greater than 30 inches (762 mm) wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

Exception: Unit skylights installed in accordance with Section 2405.5 and flashed in accordance with the manufacturer's instructions shall be permitted to be installed without a cricket or saddle.

SECTION BC 1504 PERFORMANCE REQUIREMENTS

1504.1 Wind resistance of roofs. Roof decks and roof coverings shall be designed for wind loads in accordance with Chapter 16 and Sections 1504.2, 1504.3 and 1504.4.

1504.1.1 Wind resistance of asphalt shingles. Asphalt shingles shall be tested in accordance with ASTM D 7158. Asphalt shingles shall meet the classification requirements of Table 1504.1.1 of this code for the appropriate maximum wind speed. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D 7158 and the required classification in Table 1504.1.1 of this code.

Exception: Asphalt shingles that are not included in the scope of ASTM D 7158 shall be tested and labeled to indicate compliance with ASTM D 3161 and the required classification in Table 1504.1.1 of this code.

TABLE 1504.1.1
CLASSIFICATION OF ASPHALT SHINGLES

MAXIMUM ALLOWABLE STRESS DESIGN WIND SPEED, V_{asd}	MAXIMUM BASIC DESIGN WIND SPEED, V , FROM TABLE 1609.3	ASTM D 7158 ^a CLASSIFICATION	ASTM D 3161 CLASSIFICATION
88	110	D, G or H	A, D or F
94	117	G or H	A, D or F
102	127	G or H	F
106	132	G or H	F

1504.2 Wind resistance of clay and concrete tile. Wind loads on clay and concrete tile roof coverings shall be in accordance with Section 1609.

1504.2.1 Testing. Testing of concrete and clay roof tiles shall be in accordance with Sections 1504.2.1.1 and 1504.2.1.2.

1504.2.1.1 Overturning resistance. Concrete and clay roof tiles shall be tested to determine their resistance to overturning due to wind in accordance with SBCCI SSTD 11 and this chapter.

1504.2.1.2 Wind tunnel testing. Where concrete and clay roof tiles do not satisfy the limitations in Chapter 16 of this code for rigid tile, a wind tunnel test shall be used to determine the wind characteristics of the concrete or clay tile roof covering in accordance with SBCCI SSTD 11 and this chapter.

1504.3 Wind resistance of nonballasted roofs. Roof coverings installed on roofs in accordance with Section 1507 that are mechanically attached or adhered to the roof deck shall be designed to resist the design wind load pressures for components and cladding in accordance with Section 1609.

1504.3.1 Other roof systems. Built-up, modified bitumen, fully adhered or mechanically attached single-ply roof systems, metal panel roof systems applied to a solid or closely fitted deck and other types of membrane roof coverings shall be tested in accordance with FM 4474, UL 580 or UL 1897.

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1504.3.2 Structural metal panel roof systems. Where the metal roof panel functions as the roof deck and roof covering and it provides both weather protection and support for loads, the structural metal panel roof system shall comply with this section. Structural standing-seam metal panel roof systems shall be tested in accordance with ASTM E 1592 or FM 4474. Structural through-fastened metal panel roof systems shall be tested in accordance with FM 4474, UL 580 or ASTM E 1592.

Exceptions:

1. Metal roofs constructed of cold-formed steel shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2210.1.
2. Metal roofs constructed of aluminum shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2002.1.

1504.4 Ballasted low-slope roof systems. Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings installed in accordance with Sections 1507.12 and 1507.13 shall be designed in accordance with ANSI/SPRI RP-4 and Section 1504.8 of this code.

1504.5 Edge securement for low-slope roofs. Low-slope membrane roof systems metal edge securement, except gutters, shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1, RE-2 and RE-3 of ANSI/SPRI/FM 4435 ES-1, except the basic design wind speed V shall be determined in accordance with Chapter 16 of this code.

1504.6 Physical properties. Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with Section 1507 shall demonstrate physical integrity over the working life of the roof based upon 2,000 hours of exposure to accelerated weathering tests conducted in accordance with ASTM G 152, ASTM G 155 or ASTM G 154. Those roof coverings that are subject to cyclical flexural response due to wind loads shall not demonstrate any significant loss of tensile strength for unreinforced membranes or breaking strength for reinforced membranes when tested as herein required.

1504.7 Impact resistance. Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with Section 1507 shall resist impact damage based on the results of tests conducted in accordance with ASTM D 3746, ASTM D 4272, CGSB 37-GP-52M or the "Resistance to Foot Traffic Test" in Section 5.5 of FM 4470.

1504.8 Surfacing and ballast materials. Aggregate, gravel or crushed stone shall not be used as surfacing for roof coverings.

1504.9 Reflectance. Roof coverings on roofs or setbacks with slope equal to or less than two units vertical in 12 units horizontal (17 percent) shall have:

1. A minimum initial solar reflectance of 0.7 in accordance with ASTM C 1549 or ASTM E 1918, and a minimum thermal emittance of 0.75 as determined in accordance with ASTM C 1371 or ASTM E 408; or
2. A minimum SRI of 82 as determined in accordance with ASTM E 1980.

Roof coverings on roofs or setbacks with slope greater than two units vertical in 12 units horizontal (17 percent) shall have:

1. A minimum initial solar reflectance of 0.25 in accordance with ASTM C 1549 or ASTM E 1918, and a minimum thermal emittance of 0.75 as determined in accordance with ASTM C 1371 or ASTM E 408; or
2. A minimum SRI of 39 as determined in accordance with ASTM E 1980.

Exceptions:

1. Terraces on setbacks comprising less than 25 percent of the area of the largest floor plate in the building.
2. Any portion of a roof covered by a green roof system, including such a system with agricultural plantings, in compliance with Section 1507.16 of this code.
3. Any portion of a roof used as outdoor recreation space by the occupants of the building that is landscaped, covered by wood decking or covered with a walking surface or other protective surface, provided that such walking surface or protective surface has a minimum initial solar reflectance of 0.3 as determined in accordance with ASTM C 1549 or ASTM E 1918.

4. Ballasted roofs, provided that the ballast has a minimum initial solar reflectance of 0.2 as determined in accordance with ASTM C 1549 or ASTM E 1918.
5. Any portion of a roof that is under mechanical equipment, duckboarding, decking, platform, roof tank, cooling tower or any other rooftop structure or equipment exempted by rule by the commissioner.
6. Any roof or portion of a roof composed of glass, metal, clay or concrete tile or plastic/rubber intended to simulate clay or concrete tile, wood, or slate.
7. Any portion of a roof used by a school or daycare center as a playground for children.
8. Any roof, if the amount of rooftop space not subject to exceptions 1 through 7 is in the aggregate less than 100 square feet (9.3 m²).

SECTION BC 1505 FIRE CLASSIFICATION

1505.1 General. Roof assemblies shall be divided into the classes defined below. Class A, B and C roof assemblies and roof coverings required to be listed by this section shall be tested in accordance with ASTM E 108 or UL 790. In addition, fire-retardant-treated wood roof coverings shall be tested in accordance with ASTM D 2898. The minimum roof coverings installed on buildings shall comply with Table 1505.1 of this code based on the type of construction of the building.

Exception: Skylights and sloped glazing that comply with Chapter 24 or Section 2610 of this code.

TABLE 1505.1^{a, b}
MINIMUM ROOF COVERING CLASSIFICATION
FOR TYPES OF CONSTRUCTION

IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
B	B	B	B	B	B	B	B	C ^b

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

- a. Unless otherwise required due to the location of the building within a fire district in accordance with Section D102.2.3 in Appendix D.
- b. Buildings that are not more than two stories above grade plane and having not more than 6,000 square feet (557.4 m²) of projected roof area and where there is a minimum 10-foot fire-separation distance from the leading edge of the roof to a lot line on all sides of the building, except for street fronts or public ways, shall be permitted to have roofs of No. 1 cedar or redwood shakes and No. 1 shingles in accordance with Section 1505.6.

1505.2 Class A roof assemblies. Class A roof assemblies are those that are effective against severe fire test exposure. Class A roof assemblies and roof coverings shall be listed and identified as Class A by an approved testing agency. Class A roof assemblies shall be permitted for use in buildings or structures of all types of construction.

Exceptions:

1. Class A roof assemblies include those with coverings of brick, masonry, or an exposed concrete roof deck.
2. Class A roof assemblies also include ferrous or copper shingles or sheets, metal sheets and shingles, clay or concrete roof tile or slate installed on noncombustible decks or ferrous, copper or metal sheets installed without a roof deck on noncombustible framing.
3. Class A roof assemblies include minimum 16 ounce per square foot (0.0416 kg/m²) copper sheets installed over combustible decks.
4. Class A roof assemblies include slate installed over ASTM D 226, Type II underlayment over combustible decks.

1505.3 Class B roof assemblies. Class B roof assemblies are those that are effective against moderate fire-test exposure. Class B roof assemblies and roof coverings shall be listed and identified as Class B by an approved testing agency.

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1505.4 Class C roof assemblies. Class C roof assemblies are those that are effective against light fire-test exposure. Class C roof assemblies and roof coverings shall be listed and identified as Class C by an approved testing agency.

1505.5 Construction of sloping roofs. Roofs having a slope of more than 60 degrees (1.05 rad) to the horizontal shall be constructed of material having the same fire-resistance rating as required for an exterior nonbearing wall of the building of which it is a part. When the slope is 60 degrees (1.05 rad) or less to the horizontal, the sloping roof shall be constructed as required for the roof of the building. Where the back of a false mansard is exposed to the outdoors, the back shall be covered with noncombustible material or with roof covering as required for the roof of the building.

1505.6 Fire-retardant-treated wood shingles and shakes. Fire-retardant-treated wood shakes and shingles shall be treated by impregnation with chemicals by the full-cell vacuum-pressure process, in accordance with AWWPA C1. Each bundle shall be marked to identify the manufactured unit and the manufacturer, and shall also be labeled to identify the classification of the material in accordance with the testing required in Section 1505.1, the treating company and the quality control agency.

1505.7 Special purpose roofs. Special purpose wood shingle or wood shake roofing shall conform to the grading and application requirements of Section 1507.8 or Section 1507.9. In addition, an underlayment of ⁵/₈-inch (15.9 mm) Type X water-resistant gypsum backing board or gypsum sheathing shall be placed under minimum nominal ¹/₂-inch (12.7 mm) thick wood structural panel solid sheathing or 1-inch (25.4 mm) nominal spaced sheathing.

1505.8 Building-integrated photovoltaic products. Building-integrated photovoltaic products installed as the roof covering shall be tested, listed and labeled for fire classification in accordance with Section 1505.1.

1505.9 Photovoltaic panels and modules. Rooftop-mounted photovoltaic panel systems shall be tested, listed and identified with a fire classification in accordance with UL 1703. The fire classification shall comply with Table 1505.1 of this code based on the type of construction of the building.

1505.10 Roof gardens and landscaped roofs. Roof gardens and landscaped roofs shall comply with Section 1507.16.

SECTION BC 1506 MATERIALS

1506.1 Scope. The requirements set forth in this section shall apply to the application of roof-covering materials specified herein. Roof coverings shall be applied in accordance with this chapter and the manufacturer's instructions. Installation of roof coverings shall comply with the applicable provisions of Section 1507.

1506.2 Material specifications and physical characteristics. Roof-covering materials shall conform to the applicable standards listed in this chapter. In the absence of applicable standards or where materials are of questionable suitability, testing by an approved agency shall be required by the commissioner to determine the character, quality and limitations of application of the materials.

1506.3 Product identification. Roof-covering materials shall be delivered in packages bearing the manufacturer's identifying marks and approved testing agency labels required in accordance with Section 1505. Bulk shipments of materials shall be accompanied with the same information issued in the form of a certificate or on a bill of lading by the manufacturer.

SECTION BC 1507 REQUIREMENTS FOR ROOF COVERINGS

1507.1 Scope. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's instructions.

1507.2 Asphalt shingles. The installation of asphalt shingles shall comply with the provisions of this section.

1507.2.1 Deck requirements. Asphalt shingles shall be fastened to solidly sheathed decks.

1507.2.2 Slope. Asphalt shingles shall only be used on roof slopes of two units vertical in 12 units horizontal (17-percent slope) or greater. For roof slopes from two units vertical in 12 units horizontal (17-percent slope) up to four

units vertical in 12 units horizontal (33-percent slope), double underlayment application is required in accordance with Section 1507.2.8.

1507.2.3 Underlayment. Unless otherwise noted, required underlayment shall conform to ASTM D 226, Type I, ASTM D 4869, Type I, or ASTM D 6757.

1507.2.4 Self-adhering polymer modified bitumen sheet. Self-adhering polymer modified bitumen sheet shall comply with ASTM D 1970.

1507.2.5 Asphalt shingles. Asphalt shingles shall comply with ASTM D 225 or ASTM D 3462.

1507.2.6 Fasteners. Fasteners for asphalt shingles shall be galvanized, stainless steel, aluminum or copper roofing nails, minimum 12-gage (0.105-inch (2.67 mm)) shank with a minimum $\frac{3}{8}$ inch-diameter (9.5 mm) head, of a length to penetrate through the roofing materials and a minimum of $\frac{3}{4}$ inch (19.1 mm) into the roof sheathing. Where the roof sheathing is less than $\frac{3}{4}$ inch (19.1 mm) thick, the nails shall penetrate through the sheathing. Fasteners shall comply with ASTM F 1667.

1507.2.7 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer, but not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12), shingles shall be installed as required by the manufacturer.

1507.2.8 Underlayment application. For roof slopes from two units vertical in 12 units horizontal (17-percent slope) up to four units vertical in 12 units horizontal (33-percent slope), underlayment shall be two layers applied in the following manner. Apply a minimum 19-inch (482.6 mm) wide strip of underlayment felt parallel with and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch (914.4 mm) wide sheets of underlayment overlapping successive sheets 19 inches (482.6 mm) and fastened sufficiently to hold in place. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater, underlayment shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches (50.8 mm), fastened only as necessary to hold in place. Distortions in the underlayment shall not interfere with the ability of the shingles to seal.

1507.2.8.1 Ice barrier. An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (609.6 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.2.9 Flashings. Flashing for asphalt shingles shall comply with this section. Flashing shall be applied in accordance with this section and the asphalt shingle manufacturer's instructions.

1507.2.9.1 Base and cap flashing. Base and cap flashing shall be installed in accordance with the manufacturer's instructions. Base flashing shall be of either corrosion-resistant metal of minimum nominal 0.019-inch (0.483 mm) thickness or mineral-surfaced roll roofing weighing a minimum of 77 pounds per 100 square feet (3.76 kg/m²). Cap flashing shall be corrosion-resistant metal of minimum nominal 0.019-inch (0.483 mm) thickness.

1507.2.9.2 Valleys. Valley linings shall be installed in accordance with the manufacturer's instructions before applying shingles. Valley linings of the following types shall be permitted:

1. For open valleys (valley lining exposed) lined with metal, the valley lining shall be at least 24 inches (609.6 mm) wide and of any of the corrosion-resistant metals in Table 1507.2.9.2.
2. For open valleys, valley lining of two plies of mineral-surfaced roll roofing complying with ASTM D 3909 or ASTM D 6380 shall be permitted. The bottom layer shall be 18 inches (457.2 mm) and the top layer a minimum of 36 inches (914.4 mm) wide.
3. For closed valleys (valleys covered with shingles), valley lining of one ply of smooth roll roofing complying with ASTM D 6380, and at least 36 inches (914.4 mm) wide or types as described in Item 1 or 2 above shall be permitted. Self-adhering polymer modified bitumen underlayment complying with ASTM D 1970 shall be permitted in lieu of the lining material.

**TABLE 1507.2.9.2
VALLEY LINING MATERIAL**

MATERIAL	MINIMUM THICKNESS	GAGE	WEIGHT
Aluminum	0.024 in.	—	—
Cold-rolled copper	0.0216 in.	—	ASTM B 370, 16 oz. per square ft.
Copper	—	—	16 oz.
Galvanized steel	0.0179 in.	26 (zinc-coated G90)	—
High-yield copper	0.0162 in.	—	ASTM B 370, 12 oz. per square ft.
Lead	—	—	2.5 pounds
Lead-coated copper	0.0216 in.	—	ASTM B 101, 16 oz. per square ft.
Lead-coated high-yield copper	0.0162 in.	—	ASTM B 101, 12 oz. per square ft.
Painted terne	—	—	20 pounds
Stainless steel	—	28	—
Zinc alloy	0.027 in.	—	—

For SI: 1 inch = 25.4 mm, 1 pound = 0.454 kg, 1 ounce = 28.35 g,
1 square foot = 0.0929 m².

1507.2.9.3 Drip edge. A drip edge shall be provided at eaves and rake edges of shingle roofs. Adjacent segments of the drip edge shall be lapped a minimum of 2 inches (50.8 mm). The vertical leg of drip edges shall be a minimum of 1½ inches (38.1 mm) in width and shall extend a minimum of ¼ inch (6.4 mm) below sheathing. The drip edge shall extend back on the roof a minimum of 2 inches (50.8 mm). Underlayment shall be installed over drip edges along eaves. Drip edges shall be installed over underlayment along rake edges. Drip edges shall be mechanically fastened a maximum of 12 inches (304.8 mm) on center.

1507.3 Clay and concrete tile. The installation of clay and concrete tile shall comply with the provisions of this section.

1507.3.1 Deck requirements. Concrete and clay tile shall be installed only over solid sheathing or spaced structural sheathing boards.

1507.3.2 Deck slope. Clay and concrete roof tile shall be installed on roof slopes of 2½ units vertical in 12 units horizontal (21-percent slope) or greater. For roof slopes from 2½ units vertical in 12 units horizontal (21-percent slope) to four units vertical in 12 units horizontal (33-percent slope), double underlayment application is required in accordance with Section 1507.3.3.

1507.3.3 Underlayment. Unless otherwise noted, required underlayment shall conform to: ASTM D 226, Type II; ASTM D 2626 or ASTM D 6380, Class M mineral-surfaced roll roofing.

1507.3.3.1 Low-slope roofs. For roof slopes from 2½ units vertical in 12 units horizontal (21-percent slope), up to four units vertical in 12 units horizontal (33-percent slope), underlayment shall be a minimum of two layers applied as follows:

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1. Starting at the eave, a 19-inch (482.6 mm) strip of underlayment shall be applied parallel with the eave and fastened sufficiently in place.
2. Starting at the eave, 36-inch (914.4 mm) wide strips of underlayment felt shall be applied overlapping successive sheets 19 inches (482.6 mm) and fastened sufficiently in place.

1507.3.3.2 High-slope roofs. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater, underlayment shall be a minimum of one layer of underlayment felt applied shingle fashion, parallel to, and starting from the eaves and lapped 2 inches (50.8 mm), fastened only as necessary to hold in place.

1507.3.4 Clay tile. Clay roof tile shall comply with ASTM C 1167.

1507.3.5 Concrete tile. Concrete roof tile shall comply with ASTM C 1492.

1507.3.6 Fasteners. Tile fasteners shall be corrosion resistant and not less than 11 gage, ⁵/₁₆-inch (8.0 mm) head, and of sufficient length to penetrate the deck a minimum of ³/₄ inch (19.1 mm) or through the thickness of the deck, whichever is less. Attaching wire for clay or concrete tile shall be not less than 0.083 inch (2.1 mm). Perimeter fastening areas include three tile courses but not less than 36 inches (914.4 mm) from either side of hips or ridges and edges of eaves and gable rakes.

1507.3.7 Attachment. Clay and concrete roof tiles shall be fastened in accordance with Table 1507.3.7.

TABLE 1507.3.7
CLAY AND CONCRETE TILE ATTACHMENT^{a, b, c}

GENERAL — CLAY OR CONCRETE ROOF TILE				
Maximum Nominal Design Wind Speed, V_{asd}^f (mph)	Mean roof height (feet)	Roof slope < 3:12	Roof slope 3:12 and over	
85	0–60	One fastener per tile. Flat tile without vertical laps, two fasteners per tile.	Two fasteners per tile. Only one fastener on slopes of 7:12 and less for tiles with installed weight exceeding 7.5 lbs./sq. ft. having a width not more than 16 inches.	
100	0–40			
100	> 40–60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. All rake tiles shall be nailed with two nails. The nose of all ridge, hip and rake tiles shall be set in a bead of roofer's mastic.		
110	0–60	The fastening system shall resist the wind forces in Section 1609.5.3.		
120	0–60	The fastening system shall resist the wind forces in Section 1609.5.3.		
130	0–60	The fastening system shall resist the wind forces in Section 1609.5.3.		
All	> 60	The fastening system shall resist the wind forces in Section 1609.5.3.		
INTERLOCKING CLAY OR CONCRETE ROOF TILE WITH PROJECTING ANCHOR LUGS ^{d, e} (Installations on spaced/solid sheathing with battens or spaced sheathing)				
Maximum Nominal Design Wind Speed, V_{asd}^f (mph)	Mean roof height (feet)	Roof slope < 5:12	Roof slope 5:12 < 12:12	Roof slope 12:12 and over
85	0–60	Fasteners are not required. Tiles with installed weight less than 9 lbs./sq. ft. require a minimum of one fastener per tile.	One fastener per tile every other row. All perimeter tiles require one fastener. Tiles with installed weight less than 9 lbs./sq. ft. require a minimum of one fastener per tile.	One fastener required for every tile. Tiles with installed weight less than 9 lbs./sq. ft. require a minimum of one fastener per tile.
100	0–40			
100	> 40–60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. All rake tiles shall be nailed with two nails. The nose of all ridge, hip and rake tiles shall be set in a bead of roofer's mastic.		
110	0–60	The fastening system shall resist the wind forces in Section 1609.5.3.		

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120	0–60	The fastening system shall resist the wind forces in Section 1609.5.3.
130	0–60	The fastening system shall resist the wind forces in Section 1609.5.3.
All	> 60	The fastening system shall resist the wind forces in Section 1609.5.3.
INTERLOCKING CLAY OR CONCRETE ROOF TILE WITH PROJECTING ANCHOR LUGS (Installations on solid sheathing without battens)		
Maximum Nominal Design Wind Speed, V_{asd} (mph)	Mean roof height (feet)	All roof slopes
85	0–60	One fastener per tile.
100	0–40	One fastener per tile.
100	> 40–60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. All rake tiles shall be nailed with two nails. The nose of all ridge, hip and rake tiles shall be set in a bead of roofer's mastic.
110	0–60	The fastening system shall resist the wind forces in Section 1609.5.3.
120	0–60	The fastening system shall resist the wind forces in Section 1609.5.3.
130	0–60	The fastening system shall resist the wind forces in Section 1609.5.3.
All	> 60	The fastening system shall resist the wind forces in Section 1609.5.3.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 4.882 kg/m².

- a. Minimum fastener size. Corrosion-resistant nails not less than No. 11 gage with $\frac{5}{16}$ -inch head. Fasteners shall be long enough to penetrate into the sheathing $\frac{3}{4}$ -inch or through the thickness of the sheathing, whichever is less. Attaching wire for clay and concrete tile shall not be smaller than 0.083 inch.
- b. Snow areas. A minimum of two fasteners per tile are required or battens and one fastener.
- c. Roof slopes greater than 24:12. The nose of all tiles shall be securely fastened.
- d. Horizontal battens. Battens shall be not less than 1 inch by 2 inch nominal. Provisions shall be made for drainage by a minimum of $\frac{1}{8}$ -inch riser at each nail or by 4-foot-long battens with at least a $\frac{1}{2}$ -inch separation between battens. Horizontal battens are required for slopes over 7:12.
- e. Perimeter fastening areas include three tile courses but not less than 36 inches from either side of hips or ridges and edges of eaves and gable rakes.
- f. V_{asd} shall be determined in accordance with Section 1609.3.1.

1507.3.8 Application. Tile shall be applied according to the manufacturer's instructions, based on the following:

1. Climatic conditions.
2. Roof slope.
3. Underlayment system.
4. Type of tile being installed.

1507.3.9 Flashing. At the juncture of the roof vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's instructions, and where of metal, shall not be less than 0.019-inch (0.483 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25.4 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (101.6 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch (914.4 mm) wide underlayment of either one layer of Type I underlayment running the full length of the valley, or a self-adhering polymer-modified bitumen sheet complying with ASTM D 1970, in addition to other required underlayment. For slopes under seven units vertical in 12 units horizontal (58-percent slope), the

metal valley flashing underlayment shall be solid cemented to the roofing underlayment or a self-adhering polymer modified bitumen sheet shall be installed.

1507.4 Metal roof panels. The installation of metal roof panels shall comply with the provisions of this section.

1507.4.1 Deck requirements. Metal roof panel roof coverings shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced supports.

1507.4.2 Deck slope. The minimum slope for metal roof panels shall comply with the following:

1. The minimum slope for lapped, nonsoldered seam metal roof panels without applied lap sealant shall be three units vertical in 12 units horizontal (25-percent slope).
2. The minimum slope for lapped, nonsoldered seam metal roof panels with applied lap sealant shall be one-half unit vertical in 12 units horizontal (4-percent slope). Lap sealants shall be applied in accordance with the manufacturer's instructions.
3. The minimum slope for standing-seam metal roof panel systems shall be one-quarter unit vertical in 12 units horizontal (2-percent slope).

1507.4.3 Material standards. Metal-sheet roof covering systems that incorporate supporting structural members shall be designed in accordance with Chapter 22. Metal-sheet roof coverings installed over structural decking shall comply with Table 1507.4.3(1). The materials used for metal-sheet roof coverings shall be naturally corrosion resistant or provided with corrosion resistance in accordance with the standards and minimum thicknesses shown in Table 1507.4.3(2).

**TABLE 1507.4.3(1)
METAL ROOF COVERINGS**

ROOF COVERING TYPE	STANDARD APPLICATION RATE/THICKNESS
Aluminum	ASTM B 209, 0.024 inch minimum thickness for roll-formed panels and 0.019 inch minimum thickness for press-formed shingles.
Aluminum-zinc alloy coated steel	ASTM A 792 AZ 50
Cold-rolled copper	ASTM B 370 minimum 16 oz./sq. ft. and 12 oz./sq. ft. high yield copper for metal-sheet roof covering systems; 12 oz./sq. ft. for pre-formed metal shingle systems.
Copper	16 oz./sq. ft. for metal-sheet roof-covering systems; 12 oz./sq. ft. for preformed metal shingle systems.
Galvanized steel	ASTM A 653 G-90 zinc-coated ^a
Hard lead	2 lbs./sq. ft.
Lead-coated copper	ASTM B 101
Prepainted steel	ASTM A 755
Soft lead	3 lbs./sq. ft.
Stainless steel	ASTM A 240, 300 Series Alloys
Steel	ASTM A 924

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Terne and terne-coated stainless	Terne coating of 40 lbs. per double base box, field painted where applicable in accordance with manufacturer's instructions.
Zinc	0.027 inch minimum thickness; 99.995% electrolytic high grade zinc with alloy additives of copper (0.08% - 0.20%), titanium (0.07% - 0.12%) and aluminum (0.015%).

For SI: 1 ounce per square foot = 0.305 kg/m²,
 1 pound per square foot = 4.882 kg/m²,
 1 inch = 25.4 mm, 1 pound = 0.454 kg.

- a. For Group U buildings, the minimum coating thickness for ASTM A 653 galvanized steel roofing shall be G-60.

TABLE 1507.4.3(2)
MINIMUM CORROSION RESISTANCE

MATERIAL	STANDARD
55% Aluminum-zinc alloy coated steel	ASTM A 792 AZ 50
5% Aluminum alloy-coated steel	ASTM A 875 GF60
Aluminum-coated steel	ASTM A 463 T2 65
Galvanized steel	ASTM A 653 G-90
Prepainted steel	ASTM A 755a

- a. Paint systems in accordance with ASTM A 755 shall be applied over steel products with corrosion-resistant coatings complying with ASTM A 792, ASTM A 875, ASTM A 463 or ASTM A 653.

1507.4.4 Attachment. Metal roof panels shall be secured to the supports in accordance with the approved manufacturer's fasteners. In the absence of manufacturer recommendations, the following fasteners shall be used:

1. Galvanized fasteners shall be used for steel roofs.
2. Copper, brass, bronze, copper alloy or 300 series stainless-steel fasteners shall be used for copper roofs.
3. Stainless-steel fasteners are acceptable for all types of metal roofs.
4. Aluminum fasteners are acceptable for aluminum roofs attached to aluminum supports.

1507.5 Metal roof shingles. The installation of metal roof shingles shall comply with the provisions of this section.

1507.5.1 Deck requirements. Metal roof shingles shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced sheathing.

1507.5.2 Deck slope. Metal roof shingles shall not be installed on roof slopes below three units vertical in 12 units horizontal (25-percent slope).

1507.5.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869.

1507.5.4 Ice barrier. An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (609.6 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.5.5 Material standards. Metal roof shingle roof coverings shall comply with Table 1507.4.3(1). The materials used for metal-roof shingle roof coverings shall be naturally corrosion resistant or provided with corrosion resistance in accordance with the standards and minimum thicknesses specified in the standards listed in Table 1507.4.3(2).

1507.5.6 Attachment. Metal roof shingles shall be secured to the roof in accordance with the manufacturer's instructions.

1507.5.7 Flashing. Roof valley flashing shall be of corrosion-resistant metal of the same material as the roof covering or shall comply with the standards in Table 1507.4.3(1). The valley flashing shall extend at least 8 inches (203.2 mm) from the centerline each way and shall have a splash diverter rib not less than $\frac{3}{4}$ inch (19.1 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (101.6 mm). The metal valley flashing shall have a 36-inch (914.4 mm) wide underlayment directly under it consisting of either one layer of underlayment running the full length of the valley or a self-adhering polymer-modified bitumen sheet complying with ASTM D 1970, in addition to underlayment required for metal roof shingles. For slopes under seven units vertical in 12 units horizontal (58-percent slope), the metal valley flashing underlayment shall be solid cemented to the roofing underlayment) or a self-adhering polymer modified bitumen sheet shall be installed.

1507.6 Mineral-surfaced roll roofing. The installation of mineral-surfaced roll roofing shall comply with this section.

1507.6.1 Deck requirements. Mineral-surfaced roll roofing shall be fastened to solidly sheathed roofs.

1507.6.2 Deck slope. Mineral-surfaced roll roofing shall not be applied on roof slopes below one unit vertical in 12 units horizontal (8-percent slope).

1507.6.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869.

1507.6.4 Ice barrier. An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (609.6 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.6.5 Material standards. Mineral-surfaced roll roofing shall conform to ASTM D 3909 or ASTM D 6380.

1507.7 Slate shingles. The installation of slate shingles shall comply with the provisions of this section.

1507.7.1 Deck requirements. Slate shingles shall be fastened to solidly sheathed roofs.

1507.7.2 Deck slope. Slate shingles shall only be used on slopes of four units vertical in 12 units horizontal (4:12) or greater.

1507.7.3 Underlayment. Underlayment shall comply with ASTM D 226, Type II or ASTM D 4869, Type III or IV.

1507.7.4 Ice barrier. An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet, shall extend from the lowest edges of all roof surfaces to a point at least 24 inches (609.6 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.7.5 Material standards. Slate shingles shall comply with ASTM C 406.

1507.7.6 Application. Minimum headlap for slate shingles shall be in accordance with Table 1507.7.6. Slate shingles shall be secured to the roof with two fasteners per slate.

**TABLE 1507.7.6
SLATE SHINGLE HEADLAP**

SLOPE	HEADLAP (inches)
4:12 < slope < 8:12	4
8:12 < slope < 20:12	3
slope $\geq$ 20:12	2

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For SI: 1 inch = 25.4 mm.

1507.7.7 Flashing. Flashing and counterflashing shall be made with sheet metal. Valley flashing shall be a minimum of 15 inches (381 mm) wide. Valley and flashing metal shall be a minimum uncoated thickness of 0.0179-inch (0.455 mm) zinc-coated G90. Chimneys, stucco or brick walls shall have a minimum of two plies of felt for a cap flashing consisting of a 4-inch (101.6 mm) wide strip of felt set in plastic cement and extending 1 inch (25.4 mm) above the first felt and a top coating of plastic cement. The felt shall extend over the base flashing 2 inches (50.8 mm).

1507.8 Wood shingles. The installation of wood shingles shall comply with the provisions of this section and Table 1507.8.

**TABLE 1507.8
WOOD SHINGLE AND SHAKE INSTALLATION**

ROOF ITEM	WOOD SHINGLES	WOOD SHAKES
1. Roof slope	Wood shingles shall be installed on slopes of not less than three units vertical in 12 units horizontal (3:12).	Wood shakes shall be installed on slopes of not less than four units vertical in 12 units horizontal (4:12).
2. Deck requirement		
Temperate climate	Shingles shall be applied to roofs with solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1" × 4" nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.	Shakes shall be applied to roofs with solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1" × 4" nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. When 1" × 4" spaced sheathing is installed at 10 inches, boards must be installed between the sheathing boards.
Ice forming along the eaves causing a backup of water.	Solid sheathing required.	Solid sheathing is required.
3. Interlayment	No requirements.	Interlayment shall comply with ASTM D 226, Type 1.
4. Underlayment		
Temperate climate	Underlayment shall comply with ASTM D 226, Type 1.	Underlayment shall comply with ASTM D 226, Type 1.
Ice forming along the eaves causing a backup of water.	An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall extend from the eave's edge to a point at least 24 inches inside the exterior wall line of the building.	An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall extend from the lowest eave's edge of all roof surfaces to a point at least 24 inches inside the exterior wall line of the building.
5. Application		
Attachment	Fasteners for wood shingles shall be hot-dipped galvanized or Type 304 (Type 316 for coastal areas) stainless steel with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.	Fasteners for wood shakes shall be hot-dipped galvanized or Type 304 (Type 316 for coastal areas) with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.
No. of fasteners	Two per shingle.	Two per shake.
Exposure	Weather exposures shall not exceed those set forth in Table 1507.8.7.	Weather exposures shall not exceed those set forth in Table 1507.9.8.

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Method	Shingles shall be laid with a side lap of not less than 1.5 inches between joints in courses, and no two joints in any three adjacent courses shall be in direct alignment. Spacing between shingles shall be 0.25 to 0.375 inch.	Shakes shall be laid with a side lap of not less than 1.5 inches between joints in adjacent courses. Spacing between shakes shall not be less than 0.375 inch or more than 0.625 inch for shakes and taper sawn shakes of naturally durable wood and shall be 0.25 to 0.375 inch for preservative-treated taper sawn shakes.
Flashing	In accordance with Section 1507.8.8.	In accordance with Section 1507.9.9.

For SI: 1 inch = 25.4 mm, °C = ((°F) – 32)/1.8.

1507.8.1 Deck requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25.4 mm by 101.6 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.

1507.8.1.1 Solid sheathing required. Solid sheathing is required.

1507.8.2 Deck slope. Wood shingles shall be installed on slopes of not less than three units vertical in 12 units horizontal (25-percent slope).

1507.8.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869.

1507.8.4 Ice barrier. An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (609.6 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.8.5 Material standards. Wood shingles shall be of naturally durable wood and comply with the requirements of Table 1507.8.5.

**TABLE 1507.8.5
WOOD SHINGLE MATERIAL REQUIREMENTS**

MATERIAL	APPLICABLE MINIMUM GRADES	GRADING RULES
Wood shingles of naturally durable wood	1, 2 or 3	CSSB

CSSB = Cedar Shake and Shingle Bureau

1507.8.6 Attachment. Fasteners for wood shingles shall be corrosion resistant with a minimum penetration of $\frac{3}{4}$ inch (19.1 mm) into the sheathing. For sheathing less than $\frac{1}{2}$ inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shingle shall be attached with a minimum of two fasteners.

1507.8.7 Application. Wood shingles shall be laid with a side lap not less than $1\frac{1}{2}$ inches (38.1 mm) between joints in adjacent courses, and not be in direct alignment in alternate courses. Spacing between shingles shall be $\frac{1}{4}$ to $\frac{3}{8}$ inches (6.4 to 9.5 mm). Weather exposure for wood shingles shall not exceed that set in Table 1507.8.7.

**TABLE 1507.8.7
WOOD SHINGLE WEATHER EXPOSURE AND ROOF SLOPE**

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)	
			3:12 pitch to < 4:12	4:12 pitch or steeper
Shingles of naturally durable wood	16	No. 1	3.75	5
		No. 2	3.5	4
		No. 3	3	3.5
	18	No. 1	4.25	5.5

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		No. 2	4	4.5
		No. 3	3.5	4
	24	No. 1	5.75	7.5
		No. 2	5.5	6.5
		No. 3	5	5.5

For SI: 1 inch = 25.4 mm.

1507.8.8 Flashing. At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's instructions, and where of metal, shall be not less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25.4 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (101.6 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch (914.4 mm) wide underlayment of either one layer of Type I underlayment running the full length of the valley or a self-adhering polymer-modified bitumen sheet complying with ASTM D 1970, in addition to other required underlayment. For slopes under seven units vertical in 12 units horizontal (58-percent slope), the metal valley flashing underlayment shall be solid cemented to the roofing underlayment or a self-adhering polymer modified bitumen sheet shall be installed.

1507.9 Wood shakes. The installation of wood shakes shall comply with the provisions of this section and Table 1507.8.

1507.9.1 Deck requirements. Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25.4 mm by 101.6 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25.4 mm by 101.6 mm) spaced sheathing is installed at 10 inches (254 mm) on center, additional 1-inch by 4-inch (25.4 mm by 101.6 mm) boards shall be installed between the sheathing boards.

1507.9.1.1 Solid sheathing required. Solid sheathing is required in areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water.

1507.9.2 Deck slope. Wood shakes shall only be used on slopes of not less than four units vertical in 12 units horizontal (33-percent slope).

1507.9.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869.

1507.9.4 Ice barrier. An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (609.6 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.9.5 Interlayment. Interlayment shall comply with ASTM D 226, Type I.

1507.9.6 Material standards. Wood shakes shall comply with the requirements of Table 1507.9.6.

TABLE 1507.9.6
WOOD SHAKE MATERIAL REQUIREMENTS

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING RULES
Wood shakes of naturally durable wood	1	CSSB
Taper sawn shakes of naturally durable wood	1 or 2	CSSB

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Preservative-treated shakes and shingles of naturally durable wood	1	CSSB
Fire-retardant-treated shakes and shingles of naturally durable wood	1	CSSB
Preservative-treated taper sawn shakes of Southern pine treated in accordance with AWP A U1 (Commodity Specification A, Use Category 3B and Section 5.6)	1 or 2	TFS

CSSB = Cedar Shake and Shingle Bureau.

TFS = Forest Products Laboratory of the Texas Forest Services.

1507.9.7 Attachment. Fasteners for wood shakes shall be corrosion resistant with a minimum penetration of $\frac{3}{4}$ inch (19.1 mm) into the sheathing. For sheathing less than $\frac{1}{2}$ inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shake shall be attached with a minimum of two fasteners.

1507.9.8 Application. Wood shakes shall be laid with a side lap not less than $1\frac{1}{2}$ inches (38.1 mm) between joints in adjacent courses. Spacing between shakes in the same course shall be $\frac{3}{8}$ to $\frac{5}{8}$ inches (9.5 to 15.9 mm) for shakes and taper sawn shakes of naturally durable wood and shall be $\frac{1}{4}$ to $\frac{3}{8}$ inch (6.4 to 9.5 mm) for preservative taper sawn shakes. Weather exposure for wood shakes shall not exceed those set in Table 1507.9.8.

**TABLE 1507.9.8
WOOD SHAKE WEATHER EXPOSURE AND ROOF SLOPE**

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches) 4:12 PITCH OR STEEPER
Shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10 ^a
Preservative-treated taper sawn shakes of Southern yellow pine	18	No. 1	7.5
	24	No. 1	10
	18	No. 2	5.5
	24	No. 2	7.5
Taper sawn shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10
	18	No. 2	5.5
	24	No. 2	7.5

For SI: 1 inch = 25.4 mm.

a. For 24-inch by 0.375-inch handsplit shakes, the maximum exposure is 7.5 inches.

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1507.9.9 Flashing. At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's instructions, and where of metal, shall be not less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25.4 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (101.6 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch (914.4 mm) wide underlayment of either one layer of Type I underlayment running the full length of the valley or a self-adhering polymer-modified bitumen sheet complying with ASTM D 1970, in addition to other required underlayment. For slopes under seven units vertical in 12 units horizontal (58-percent slope) the metal valley flashing underlayment shall be solidly cemented to the roofing underlayment or a self-adhering polymer-modified bitumen sheet shall be installed.

1507.10 Built-up roofs. The installation of built-up roofs shall comply with the provisions of this section.

1507.10.1 Slope. Built-up roofs shall have a slope designed and built to provide positive roof drainage.

1507.10.2 Material standards. Built-up roof covering materials shall comply with UL 55A or the standards in Table 1507.10.2 of this code.

**TABLE 1507.10.2
BUILT-UP ROOFING MATERIAL STANDARDS**

MATERIAL STANDARD	STANDARD
Acrylic coatings used in roofing	ASTM D 6083
Aggregate surfacing	ASTM D 1863
Asphalt adhesive used in roofing	ASTM D 3747
Asphalt cements used in roofing	ASTM D 3019; D 2822; D 4586
Asphalt-coated glass fiber base sheet	ASTM D 4601
Asphalt coatings used in roofing	ASTM D 1227; D 2823; D 2824; D 4479
Asphalt glass felt	ASTM D 2178
Asphalt primer used in roofing	ASTM D 41
Asphalt-saturated and asphalt-coated organic felt base sheet	ASTM D 2626
Asphalt-saturated organic felt (perforated)	ASTM D 226
Asphalt used in roofing	ASTM D 312
Coal-tar cements used in roofing	ASTM D 4022; D 5643
Coal-tar saturated organic felt	ASTM D 227
Coal-tar pitch used in roofing	ASTM D 450; Type I or II
Coal-tar primer used in roofing, dampproofing and waterproofing	ASTM D 43
Glass mat, coal tar	ASTM D 4990
Glass mat, venting type	ASTM D 4897
Mineral-surfaced inorganic cap sheet	ASTM D 3909
Thermoplastic fabrics used in roofing	ASTM D 5665, D 5726

1507.11 Modified bitumen roofing. The installation of modified bitumen roofing shall comply with the provisions of this section.

1507.11.1 Slope. Modified bitumen membrane roofs shall have a slope designed and built to provide positive roof drainage.

1507.11.2 Material standards. Modified bitumen roof coverings shall comply with CGSB 37-GP-56M, ASTM D 6162, ASTM D 6163, ASTM D 6164, ASTM D 6222, ASTM D 6223, ASTM D 6298 or ASTM D 6509.

1507.12 Thermoset single-ply roofing. The installation of thermoset single-ply roofing shall comply with the provisions of this section.

1507.12.1 Slope. Thermoset single-ply membrane roofs shall have a slope designed and built to provide positive roof drainage.

1507.12.2 Material standards. Thermoset single-ply roof coverings shall comply with ASTM D 4637, ASTM D 5019 or CGSB 37-GP-52M.

1507.12.3 Ballasted thermoset low-slope roofs. Ballasted thermoset low-slope roofs (roof slope < 2:12) shall be installed in accordance with this section and Section 1504.4, and subject to the limitations of Section 1504.8.

1507.13 Thermoplastic single-ply roofing. The installation of thermoplastic single-ply roofing shall comply with the provisions of this section.

1507.13.1 Slope. Thermoplastic single-ply membrane roofs shall have a slope designed and built to provide positive roof drainage.

1507.13.2 Material standards. Thermoplastic single-ply roof coverings shall comply with ASTM D 4434, ASTM D 6754, ASTM D 6878 or CAN/CGSB 37-54.

1507.13.3 Ballasted thermoplastic low-slope roofs. Ballasted thermoplastic low-slope roofs (roof slope < 2:12) shall be installed in accordance with this section and Section 1504.4, and subject to the limitations of Section 1504.8.

1507.14 Sprayed polyurethane foam roofing. The installation of sprayed polyurethane foam roofing shall comply with the provisions of this section.

1507.14.1 Slope. Sprayed polyurethane foam roofs shall have a slope designed and built to provide positive roof drainage.

1507.14.2 Material standards. Spray-applied polyurethane foam insulation shall comply with Type III or IV as defined in ASTM C 1029.

1507.14.3 Application. Foamed-in-place roof insulation shall be installed in accordance with the manufacturer's instructions. A liquid-applied protective coating that complies with Table 1507.14.3 shall be applied no less than 2 hours nor more than 72 hours following the application of the foam.

**TABLE 1507.14.3
PROTECTIVE COATING MATERIAL STANDARDS**

MATERIAL	STANDARD
Acrylic coating	ASTM D 6083
Silicone coating	ASTM D 6694
Moisture-cured polyurethane coating	ASTM D 6947

1507.14.4 Foam plastics. Foam plastic materials and installation shall comply with Chapter 26.

1507.15 Liquid-applied roofing. The installation of liquid-applied roofing shall comply with the provisions of this section.

1507.15.1 Slope. Liquid-applied roofing shall have a slope designed and built to provide positive roof drainage.

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1507.15.2 Material standards. Liquid-applied roofing shall comply with ASTM C 836, ASTM C 957, ASTM D 1227 or ASTM D 3468, ASTM D 6083, ASTM D 6694 or ASTM D 6947.

1507.16 Vegetative roofs, roof gardens and landscaped roofs. Vegetative roofs, roof gardens and landscaped roofs shall comply with the provisions of this section and *New York City Fire Code*.

1507.16.1 Design standards. Vegetative roofs, roof gardens and landscaped roofs shall comply with ANSI/SPRI RP-14 and ANSI/SPRI VF-1, or with FM DS 1-35.

Exceptions:

1. The aggregate area of landscaping materials or growth media or both on any single roof level of a building or structure is 250 square feet (23.2 m²) or less.
2. The roof area is 22 feet (6705.6 mm) or less from grade.
3. The vegetative roof system is a container garden.

1507.16.2 Roof structure. The roof structure shall comply with Chapter 16 for the design of the vegetative roofs, roof gardens and landscaped roofs.

1507.16.3 Roof covering. Roof covering shall comply with Section 1507.10, 1507.11, 1507.12, 1507.13 or 1507.15.

1507.16.4 Slope. The roofing membrane shall have a design slope in accordance with the roof covering utilized. Overburden shall be installed to prevent slippage tested as an assembly.

1507.16.5 Structural fire resistance. The structural frame and roof construction supporting the load imposed upon the roof by the vegetative roof, roof gardens or landscaped roofs shall comply with the requirements of Table 601.

1507.17 Photovoltaic shingles. The installation of photovoltaic shingles shall comply with the provisions of this section.

1507.17.1 Deck requirements. Photovoltaic shingles shall be applied to a solid or closely fitted deck, except where the shingles are specifically designed to be applied over spaced sheathing.

1507.17.2 Deck slope. Photovoltaic shingles shall not be installed on roof slopes less than three units vertical in 12 units horizontal (25-percent slope).

1507.17.3 Underlayment. Unless otherwise noted, required underlayment shall conform to ASTM D 226, ASTM D 4869 or ASTM D 6757.

1507.17.4 Underlayment application. Underlayment shall be applied shingle fashion, parallel to and starting from the eave, lapped 2 inches (50.8 mm) and fastened sufficiently to hold in place.

1507.17.4.1 High wind attachment. Underlayment applied in areas subject to high winds (V_{asd} greater than 110 mph (49.1 m/s) as determined in accordance with Section 1609.3.1) shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's instructions. Fasteners shall be applied along the overlap at not more than 36 inches (914.4 mm) on center. Underlayment installed where V_{asd} is not less than 120 mph (53.6 m/s) shall comply with ASTM D 226, Type II, ASTM D 4869, Type IV or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (304.8 mm) between side laps with a 6-inch (152.4 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section 1507.2.8 except all laps shall be a minimum of 4 inches (101.6 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of not less than 32-gage (0.0134 inch (0.34 mm)) sheet metal. The cap nail shank shall be a minimum of 12 gage (0.105 inch (2.67 mm)) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19.1 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

1507.17.4.2 Ice barrier. An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet shall be used instead of normal underlayment and extend from the lowest edges of all roof surfaces to a point not less than 24 inches (609.6 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.17.5 Fasteners. Fasteners for photovoltaic shingles shall be galvanized, stainless steel, aluminum or copper roofing nails, minimum 12-gage (0.105 inch (2.67 mm)) shank with a minimum $\frac{3}{8}$ -inch (9.5 mm) diameter head, of a length to penetrate through the roofing materials and a minimum of $\frac{3}{4}$ inch (19.1 mm) into the roof sheathing. Where the roof sheathing is less than $\frac{3}{4}$ inch (19.1 mm) thick, the nails shall penetrate through the sheathing. Fasteners shall comply with ASTM F 1667.

1507.17.6 Material standards. Photovoltaic shingles shall be listed and labeled in accordance with UL 1703.

1507.17.7 Attachment. Photovoltaic shingles shall be attached in accordance with the manufacturer's instructions.

1507.17.8 Wind resistance. Photovoltaic shingles shall be tested in accordance with procedures and acceptance criteria in ASTM D 3161. Photovoltaic shingles shall comply with the classification requirements of Table 1504.1.1 of this code for the appropriate maximum nominal design wind speed. Photovoltaic shingle packaging shall bear a label to indicate compliance with the procedures in ASTM D 3161 and the required classification from Table 1504.1.1 of this code.

SECTION BC 1508 ROOF INSULATION

1508.1 General. The use of above-deck thermal insulation shall be permitted provided such insulation is covered with an approved roof covering and passes the tests of NFPA 276 or UL 1256 when tested as an assembly.

Exceptions:

1. Foam plastic roof insulation shall conform to the material and installation requirements of Chapter 26 of this code.
2. Where a concrete roof deck is used and the above-deck thermal insulation is covered with an approved roof covering.

1508.1.1 Cellulosic fiberboard. Cellulosic fiberboard roof insulation shall conform to the material and installation requirements of Chapter 23.

1508.2 Material standards. Above-deck thermal insulation board shall comply with the standards in Table 1508.2.

**TABLE 1508.2
MATERIAL STANDARDS FOR ROOF INSULATION**

MATERIAL	STANDARD
Cellular glass board	ASTM C 552
Composite boards	ASTM C 1289, Type III, IV, V or VI
Expanded polystyrene	ASTM C 578
Extruded polystyrene	ASTM C 578
Fiber-reinforced gypsum board	ASTM C 1278
Glass-faced gypsum board	ASTM C 1177
Mineral fiber insulation board	ASTM C 726
Perlite board	ASTM C 728
Polyisocyanurate board	ASTM C 1289, Type I or II
Wood fiberboard	ASTM C 208

**SECTION BC 1509
RADIANT BARRIERS INSTALLED ABOVE DECK**

1509.1 General. A radiant barrier installed above a deck shall comply with Sections 1509.2 through 1509.4.

1509.2 Fire testing. Radiant barriers shall be permitted for use above decks where the radiant barrier is covered with an approved roof covering and the system consisting of the radiant barrier and the roof covering complies with the requirements of either FM 4550 or UL 1256.

1509.3 Installation. The low emittance surface of the radiant barrier shall face the continuous airspace between the radiant barrier and the roof covering.

1509.4 Material standards. A radiant barrier installed above a deck shall comply with ASTM C 1313/1313M.

**SECTION BC 1510
ROOFTOP STRUCTURES**

1510.1 General. The provisions of this section shall govern the construction of rooftop structures. All rooftop structures shall be subject to the roof area coverage limitations and building height requirements of Chapter 5. Rooftop structures shall be constructed with materials as required for the building, except as provided for in this section.

††† **1510.2 Bulkheads and penthouses.** Bulkheads and penthouses shall comply with the construction requirements of this section.

1510.2.1 Type of construction. Bulkheads and penthouses shall be constructed with walls, floors and roof as required for the building.

Exceptions: Where the total aggregate area of all rooftop structures does not exceed $33\frac{1}{3}\%$ percent of the area of the roof of the building upon which they are erected, the following shall apply:

1. Bulkheads on buildings of Type I and II construction. The exterior walls and roofs of such bulkheads with a fire separation distance of more than 5 feet (1524 mm) and less than 30 feet (9144 mm) shall be of at least 1-hour fire-resistance-rated noncombustible construction. Walls and roofs with a fire separation distance of 30 feet (9144 mm) or greater shall be of noncombustible construction. Interior framing and walls shall be of noncombustible construction.
2. Bulkheads on buildings of Type III, IV and V construction. The exterior walls of such bulkheads with a fire separation distance of more than 5 feet (1524 mm) and less than 30 feet (9144 mm) shall be at least 1-hour fire-resistance-rated construction. Walls with a fire separation distance of 30 feet (9144 mm) or greater from a common property line shall be of Type IV construction, or noncombustible construction. Roofs shall be constructed of materials and fire-resistance rated as required in Table 601. Interior framing and walls shall be Type IV or noncombustible or fire-retardant-treated wood construction.

1510.2.2 Penthouses. Enclosed walls of penthouses shall comply with the requirements for exterior walls as per Tables 601 and 602 for the construction class of the building on which they are erected. Roofs of penthouses shall comply with the requirements for roof construction of Table 601 and Chapter 15.

1510.2.3 Bulkheads. An enclosed rooftop structure not intended for human occupancy shall not be used for purposes other than shelter of mechanical equipment or shelter of vertical shaft openings in the roof. Provisions, such as louvers, louver blades or flashing, shall be made to protect the mechanical equipment and the building interior from the elements.

1510.3 Tanks. Tanks having a capacity of more than 500 gallons (1892.7 L) located on the roof deck of a building shall be supported on masonry, reinforced concrete, steel or Type IV construction provided that, where such supports are located in the building above the lowest story, the support shall be fire-resistance rated as required for Type IA construction.

1510.3.1 Valve and drain. On the bottom or on the side near the bottom of the tank, a pipe or outlet, fitted with a suitable quick-opening valve for discharging the contents into a drain in an emergency shall be provided.

1510.3.2 Location. Tanks shall not be placed over or near a stairway or an elevator shaft, unless there is a solid roof or floor underneath the tank.

1510.3.3 Tank cover. Unenclosed roof tanks shall have covers sloping toward the perimeter of the tanks.

1510.4 Cooling towers. Cooling towers shall be of noncombustible construction.

Exceptions:

1. Fill and drift eliminators of limited combustible materials may be considered noncombustible if the cooling towers are provided with automatic sprinkler protection complying with Section 903.
2. Fill and drift eliminators that comply with Section 908 of the *New York City Mechanical Code*.

1510.5 Steeples, minarets, spires, domes and cupolas. Steeples, minarets, spires, domes, cupolas and other similar architectural elements not used for occupancy or storage, shall be constructed of materials consistent with the required type of construction of the building and shall be of a type of construction having fire-resistance ratings not less than required for the building on top of which such steeple, minaret, spire, dome or cupola is built.

1510.5.1 Noncombustible construction required. Steeples, minarets, spires, domes and cupolas greater than 60 feet (18 288 mm) in height above the highest point at which such structure contacts the roof as measured to the highest point on such structure, or that exceeds 200 square feet (18.6 m²) in area at any horizontal section, or which is intended to be used for any purpose other than as a belfry or architectural embellishment, or is located on the top of a building greater than 50 feet (1524 mm) in building height shall be constructed of and supported by noncombustible materials and shall be separated from the building below by construction having a fire-resistance rating of not less than 1.5 hours with openings protected in accordance with Section 712. Such structures located on the top of a building greater than 50 feet (15 240 mm) in building height, shall be supported by noncombustible construction.

1510.5.2 Steeples, minarets and spires. Steeples, minarets, and spires shall have exterior walls constructed as required for the building on top of which such steeples, minarets and spires are built. The roof covering of spires shall be not less than the same class of roof covering required for the building on top of which the spire is located.

1510.6 Dormers. Dormers shall have exterior walls as required for the building to which they are attached. The roof covering of dormers shall be of a class of roof covering as required for the main roof of the rest of the structure.

1510.7 Greenhouses. Greenhouses used for the cultivation of plants, on the roofs of buildings other than buildings of Type V construction, shall be constructed of noncombustible framework and shall be glazed with plain or wire glass, or light transmitting plastic glazing complying with the requirements of Section 2606. The floors of greenhouses shall be constructed to be at least equal to the requirements for roof construction on Table 601 for the construction class of the building on which it is located.

1510.8 Protective guards. Buildings greater than 22 feet (6706 mm) in height with roof slopes less than 2.4 units vertical in 12 units horizontal (20-percent slope) shall be provided with a parapet, guards, fence, or combination thereof, not less than 42 inches (1067 mm) in height. Guards or fences may be located inward from the face of the exterior wall a distance not exceeding 6 feet (1828.8 mm). Guards or fences shall be of noncombustible material, except on buildings of Type V construction. Guards shall be constructed to comply with the requirements of Sections 1015 and 1607.8.

1510.8.1 Fences on roofs used for recreational purposes. Rooftops used for recreational purposes shall be provided with wire fencing at least 10 feet (3048 mm) in height. Openings in the fence shall not permit the passage of a 4-inch (101.6 mm) diameter sphere. Where ball games are played on rooftops the wire fencing shall be extended to provide an overhead closure.

1510.9 Miscellaneous combustible roof structures. The following roof structures may be constructed of combustible material if less than 12 feet (3657.6 mm) high above the roof: antenna supports; flagpoles; clothes drying frames; duckboarding; decking or platforms that do not cover more than 20 percent of the contiguous roof area at that level.

1510.10 Mechanical equipment screens. Mechanical equipment screens shall be constructed of the materials specified for the exterior walls in accordance with the type of construction of the building.

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1510.10.1 Type V construction. The height of mechanical equipment screens located on the roof decks of buildings of Type V construction, as measured from grade plane to the highest point on the mechanical equipment screen, shall be permitted to exceed the maximum building height allowed for the building by other provisions of this code where complying with any one of the following limitations, provided the fire separation distance is greater than 5 feet (1524 mm):

1. Where the fire separation distance is not less than 20 feet (6096 mm), the height above grade plane of the mechanical equipment screen shall not exceed 4 feet (1220 mm) more than the maximum building height allowed;
2. The mechanical equipment screen shall be constructed of noncombustible materials;
3. The mechanical equipment screen shall be constructed of fire-retardant-treated wood complying with Section 2303.2 for exterior installation; or
4. Where the fire separation distance is not less than 20 feet (6096 mm), the mechanical equipment screen shall be constructed of materials having a flame spread index of 25 or less when tested in the minimum and maximum thicknesses intended for use with each face tested independently in accordance with ASTM E 84 or UL 723.

1510.11 Photovoltaic systems. Rooftop mounted photovoltaic systems shall be designed in accordance with this section.

1510.11.1 Wind resistance. Rooftop mounted photovoltaic systems shall be designed for wind loads for component and cladding in accordance with Chapter 16 using an effective wind area based on the dimensions of a single unit frame.

1510.11.2 Fire classification. Rooftop mounted photovoltaic panels and modules shall have the fire classification in accordance with Section 1505.9.

1510.11.3 Installation. Rooftop mounted photovoltaic panels and modules shall be installed in accordance with the manufacturer's instructions.

1510.11.4 Photovoltaic panels and modules. Photovoltaic panels and modules mounted on top of a roof shall be listed and labeled in accordance with UL 1703 and shall be installed in accordance with the manufacturer's instructions.

SECTION BC 1511 REROOFING

1511.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Exceptions:

1. Section 1504.9 shall not apply if the area to be recovered or replaced is less than 50 percent of the roof area and less than 500 square feet (46.5 m²).
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1503.4 for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4.

1511.1.1 Slope. Reroofs shall provide positive drainage.

1511.2 Structural and construction loads. Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.

1511.3 Roof replacement. Roof replacement shall include the removal of all existing layers of roof coverings down to the roof deck.

Exception: Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507.

1511.3.1 Roof recover. The installation of a new roof covering over an existing roof covering shall be permitted where any of the following conditions occur:

1. Where the new roof covering is installed in accordance with the roof covering manufacturer's instructions.
2. Complete and separate roofing systems, such as standing-seam metal roof panel systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
3. Metal panel, metal shingle and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs when applied in accordance with Section 1511.4.
4. The application of a new protective coating over an existing spray polyurethane foam roofing system shall be permitted without tear-off of existing roof coverings.

1511.3.1.1 Exceptions. A roof recover shall not be permitted where any of the following conditions occur:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

1511.4 Roof recovering. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other approved materials securely fastened in place.

1511.5 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled.

1511.6 Flashings. Flashings shall be reconstructed in accordance with manufacturer's instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

1511.7 Roof assembly. Roof assembly shall be designed and constructed to meet the requirements of the *New York City Energy Conservation Code*.

SECTION BC 1512

SOLAR PHOTOVOLTAIC PANELS/MODULES AND REQUIRED SUSTAINABLE ROOFING ZONES

1512.1 Solar photovoltaic panels/modules. Solar photovoltaic panels/modules installed upon a roof or as an integral part of a roof assembly shall comply with the requirements of this code and the *New York City Fire Code*.

1512.1.1 Structural fire resistance. The structural frame and roof construction supporting the load imposed upon the roof by the photovoltaic panels/modules shall comply with the requirements of Table 601 of this code.

1512.2 Sustainable roofing zone. A sustainable roofing zone shall be required on 100 percent of the roof. For such sustainable roofing zone:

1. A contiguous area of a sustainable roofing zone measuring less than 200 square feet (18.5 m²), or in the case of a building five stories or less in height where the main use or dominant occupancy is classified as Group R, such an area measuring less than 100 square feet (9.3 m²), shall be equipped with at least a solar photovoltaic electricity generating system if such system would accommodate at least 5.44 hp (4kW) of solar photovoltaic electricity generating capacity, as determined by the department; and

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2. A sustainable roofing zone with a slope less than or equal to two units vertical in 12 units horizontal (17-percent) that would accommodate less than 5.44 hp (4kW) of solar photovoltaic electricity generating capacity, as determined by the department, shall be equipped with at least a green roof system.

Exceptions:

1. Areas required to be set aside for setbacks or access pursuant to the *New York City Fire Code*, the *New York City Construction Codes*, or the *Zoning Resolution of the City of New York*.
2. Areas occupied by rooftop structures, mechanical equipment, towers, parapets, guardrails, solar thermal systems, and appurtenances.
3. Areas occupied by obstructions related to stormwater management practices including, but not limited to, cisterns, or reuse systems that are installed to comply with site connection or stormwater construction permits issued by the department of environmental protection.
4. Terraces on setbacks comprising less than 25 percent of the area of the largest floor plate in the building.
5. Recreational spaces that are principal to the use of the building on which the rooftop is located.
6. A roof assembly with a slope greater than two units vertical in 12 units horizontal (17-percent) that would accommodate less than 4kW of solar photovoltaic electricity generating capacity.
7. Areas where site conditions are determined by the department to be unfavorable to either a solar photovoltaic electricity generating system or a green roof system.